Pacific Gas and Electric Company

Iain Baker
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May 6, 2020

Jan Zimmerman
Amanda Lopez
Shelby Barker
California Regional Water Quality Control Board, Lahontan Region
15095 Amargosa Road
Victorville, California 92394

Subject: Transmittal of the *Source Area Investigation: Boring Under Surface Impoundment Geotechnical Evaluation*, *Pacific Gas and Electric Company, Hinkley Compressor Station, Hinkley*, *California*

Dear Ms. Zimmerman, Ms. Lopez, and Ms. Barker:

On April 29, 2020, a workplan was submitted in accordance with 2015 Cleanup and Abatement Order (R6V-2015-0068; 2015 CAO) Attachment 8 Section II.C proposing remedy enhancements to improve effectiveness and expedite progress toward the 2015 CAO goals (Arcadis 2020; Action Plan). One of the areas proposed for additional investigation and potential remedial enhancements is the northern Source Area in the vicinity of the Hinkley Compressor Station surface impoundments. The enclosed geotechnical evaluation assesses a low likelihood that proposed angled borings beneath one of the surface impoundments may adversely affect the surface impoundments. This geotechnical evaluation is presented as a supplement to the Action Plan.

Please call me at (415) 314-8530 if you have any questions regarding the enclosed report.

Sincerely,

Iain Baker

Copies:
Patrice Copeland

Enclosure: *Source Area Investigation: Boring under Surface Impoundment Geotechnical Evaluation, Pacific Gas and Electric Company, Hinkley Compressor Station, Hinkley, California*

References:
Arcadis. 2020. 2020 Remedial Timeframe Assessment Action Plan, Pacific Gas and Electric Company, Hinkley Compressor Station, Hinkley, California. April 29.

MEMO

ARCADIS Design & Consultancy for natural and built assets

To:

Project File

Copies:

Erika Carter, PhD

Margy Gentile, PhD, PE

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101 Creekside Ridge Court
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From:

Nicholas R. Trimble, PE

Date:

May 6, 2020

Arcadis Project No.:

30019050.00005

Subject:

Northern Source Area Investigation: Boring under Surface Impoundment
Geotechnical Evaluation
Pacific Gas and Electric Company, Hinkley Compressor Station
Hinkley, California

This Technical Memorandum presents geotechnical considerations related to installation of two angled wells beneath a lined surface water impoundment (Pond 8) at the Pacific Gas and Electric Company (PG&E) Hinkley Compressor Station in Hinkley, California. The angled wells are being installed to support remediation efforts at the site. Geotechnical considerations include an evaluation of the potential for adverse effects to Pond 8 from the boring installation and recommended best practices to minimize the potential for adverse impacts.

Background and Introduction

Pond 8 is approximately 540 feet by 265 feet in footprint and is approximately 10 feet deep. The pond was constructed with 3H:1V side-slopes and has a double 60-mil HDPE liner with leak detection system which is underlain by a 2-foot-thick compacted clay liner. A record drawing of the pond liner system dated March 1991 is attached to this memorandum. It is expected that the liner will be replaced in the near future.

The angled wells will be installed using sonic drilling methods at an angle of 45 degrees with the horizontal to a vertical depth of 130 feet below ground surface (bgs) as shown on drawing C1 (attached). The diameter of the boreholes will be approximately 8 inches. The top of the proposed angled borings will be placed approximately 70 horizontal feet from the Pond 8 shoreline and will maintain at least 45 feet of separation from the Pond 8 clay liner.

A 4-inch-diameter, 25 to 35-foot-long pre-packed well screen will be used to construct the well after the sonic boreholes are installed. The final length of the well screen will be determined by the vertical aquifer thickness observed during drilling corrected for the angle of the borehole. Hydrated bentonite chips will be installed to separate the well screen and pre-pack from the neat-cement well seal. Additional details regarding the well installation and construction details will be documented in a forthcoming work plan.

Possible geotechnical concerns with drilling beneath Pond 8 are:

- The potential for soil settlement due to ground vibrations, which could lead to differential settlement of the pond floor,
- the potential for creating subsurface voids, which could lead to differential settlement of the pond floor, or
- grout or drilling fluid hydrofracturing of the shallow subsurface formation, which could lead to damage to the pond liner.

Subsurface Conditions

Boring logs for monitoring wells installed near Pond 8 are provided in the ROWD (TRC 2019) and show that the subsurface soil generally consists of relatively clean sand with layers of silty sand and infrequent seams of lean clay that are less than 5 feet thick. Standard Penetrometer Test (SPT) blow counts collected during monitoring well MW-15 installation in 1988 indicate that soils are medium dense to very dense from ground surface to the total depth of the boring at 120 feet bgs. Soil borings EB-1 and EB-2 were installed in 2019 adjacent to Pond 8 as part of a liner replacement geotechnical investigation. The EB-1 and EB-2 boring logs show that soil is loose to very dense from a depth of 5 feet where SPT began to the total depth of boring at 20 feet bgs. Blow counts in MW-15, EB-1, and EB-2 generally increased with depth.

Vibration

Sonic drilling is commonly used in drilling beneath structures and foundations. Sonic drilling is sometimes used to install micropiles to underpin existing foundations. High-frequency sonic vibrations are less damaging to existing structures than more conventional driven piles that produce low-frequency vibrations. The minimum separation between the sonic boring and the pond liner is at least 45 feet, so the potential for high-frequency vibrations from sonic drilling to damage Pond 8 is considered low.

Subsurface Voids

Creation of subsurface voids could lead to settlement of overlying infrastructure. The potential for differential settlement can be reduced by minimizing and backfilling any subsurface voids that are created during the drilling and well construction process. Drilling methods that rely on pressurized fluids to return spoils to the surface can cause erosion of the borehole walls and/or subsurface crack walls (USACE 2014). Sonic drilling limits the potential for void creation compared with other drilling methods because it uses a fully-cased borehole and does not rely on drilling fluids to return spoils to the surface. The proposed drilling and backfilling procedures were designed to minimize the creation of subsurface voids, so the potential for differential settlement of Pond 8 is considered low.

Hydrofracture

Sonic drilling is preferred by the USACE for drilling in dam and levee embankments because it does not require pressurized fluids (USACE 2014). The potential for hydrofracturing can be reduced by using dry drilling methods and by maintaining adequate separation from Pond 8. Sonic drilling is a dry fully-cased

drilling method, and the borehole will be backfilled with neat cement grout. The relatively small head created by the grout at shallow depths near the pond and the relatively large horizontal and vertical separation from Pond 8 are unlikely to adversely affect Pond 8.

Recommendations

The following measures should be implemented during the drilling and well installation to minimize the potential for subsurface void creation:

- Neat cement should be tremied into place as the drill casing is withdrawn to completely fill any void space between the well casing and borehole. The project team should consider using a quick-setting cement and/or staging the casing withdrawal and grouting to reduce the hydrostatic pressure in the grout to reduce the potential for excessive grout seepage into the bentonite and/or surrounding native soil formation.
- If problems are encountered during well installation that require a borehole or partially constructed well to be abandoned-in-place, any subsurface voids should be backfilled with neat cement.

Concerns about installing an angled well in this location are largely related to the ability to construct a well. California EPA DTSC (2014) states that, “Installation of the filter pack and annular seal [in an angled well] may be difficult.” The planned installation angle of 45 degrees with the horizontal was selected based on the driller’s experience. If the borehole must be abandoned due to problems encountered when installing the well at the planned angle, a new borehole/well should be attempted at an angle closer to vertical to reduce the potential for problems during well installation.

Geotechnical considerations of the drilling and well installation plan were evaluated. Assuming the recommendations presented above are incorporated, there is a low risk of any adverse effects to Pond 8 due to the installation of the angled boring from vibration, settlement, or hydrofracture.

If the horizontal separation between the well and the Pond 8 perimeter berm will be reduced to 20 feet or less, a more detailed evaluation should be performed to verify the proposed spacing is adequate to protect Pond 8.

Attachments

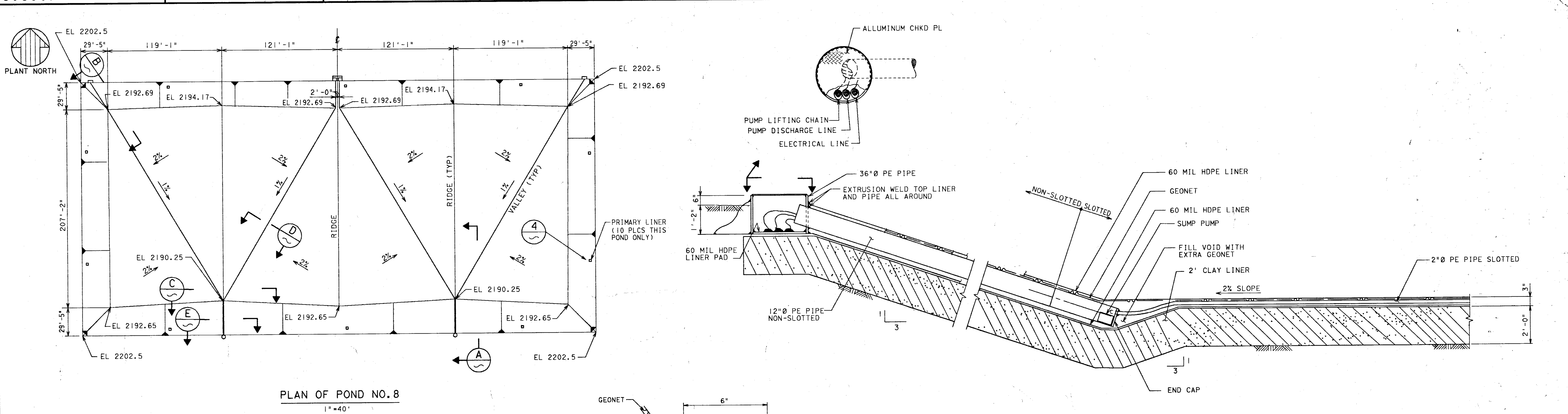
Record drawing
Drawing C1

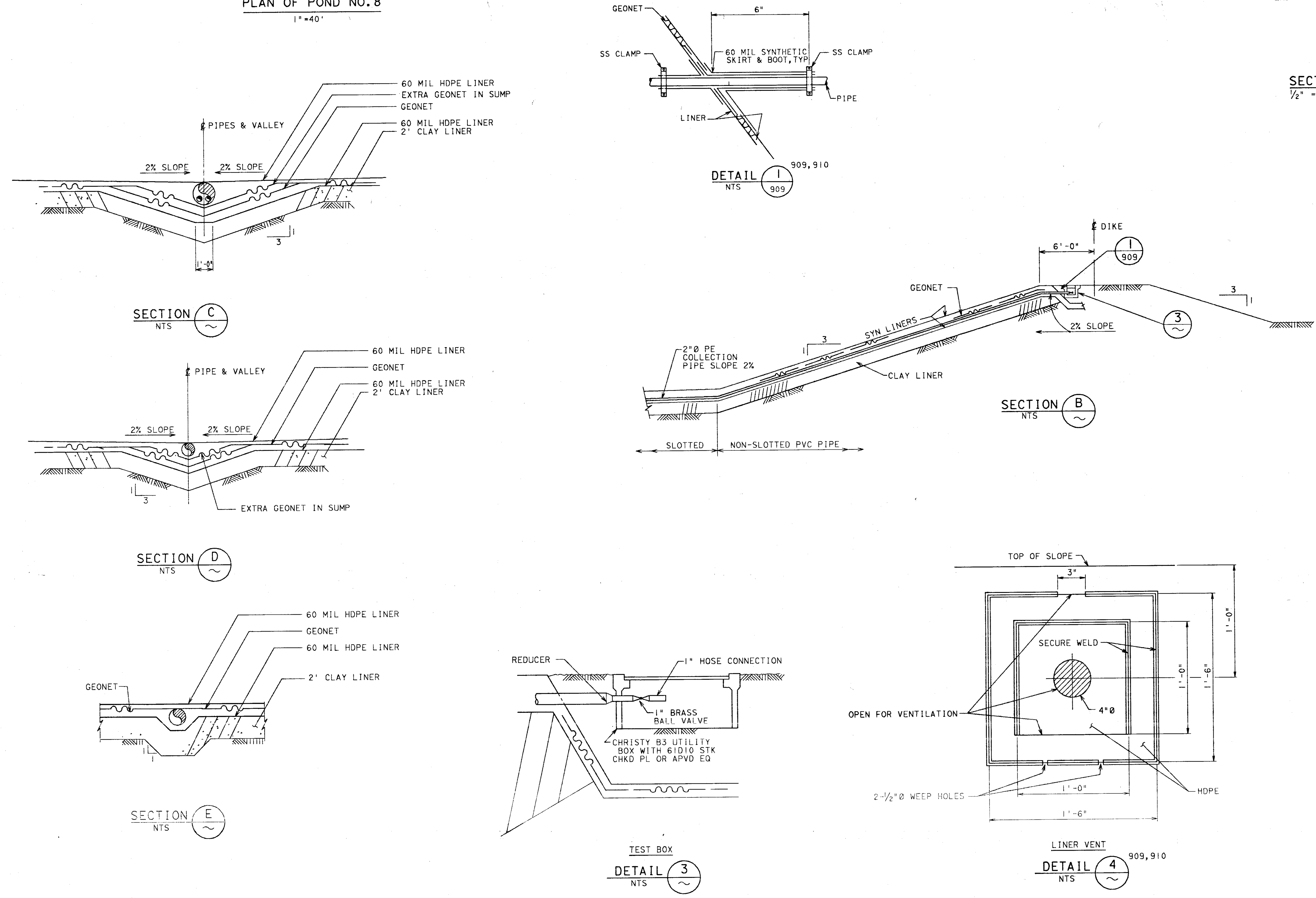
References

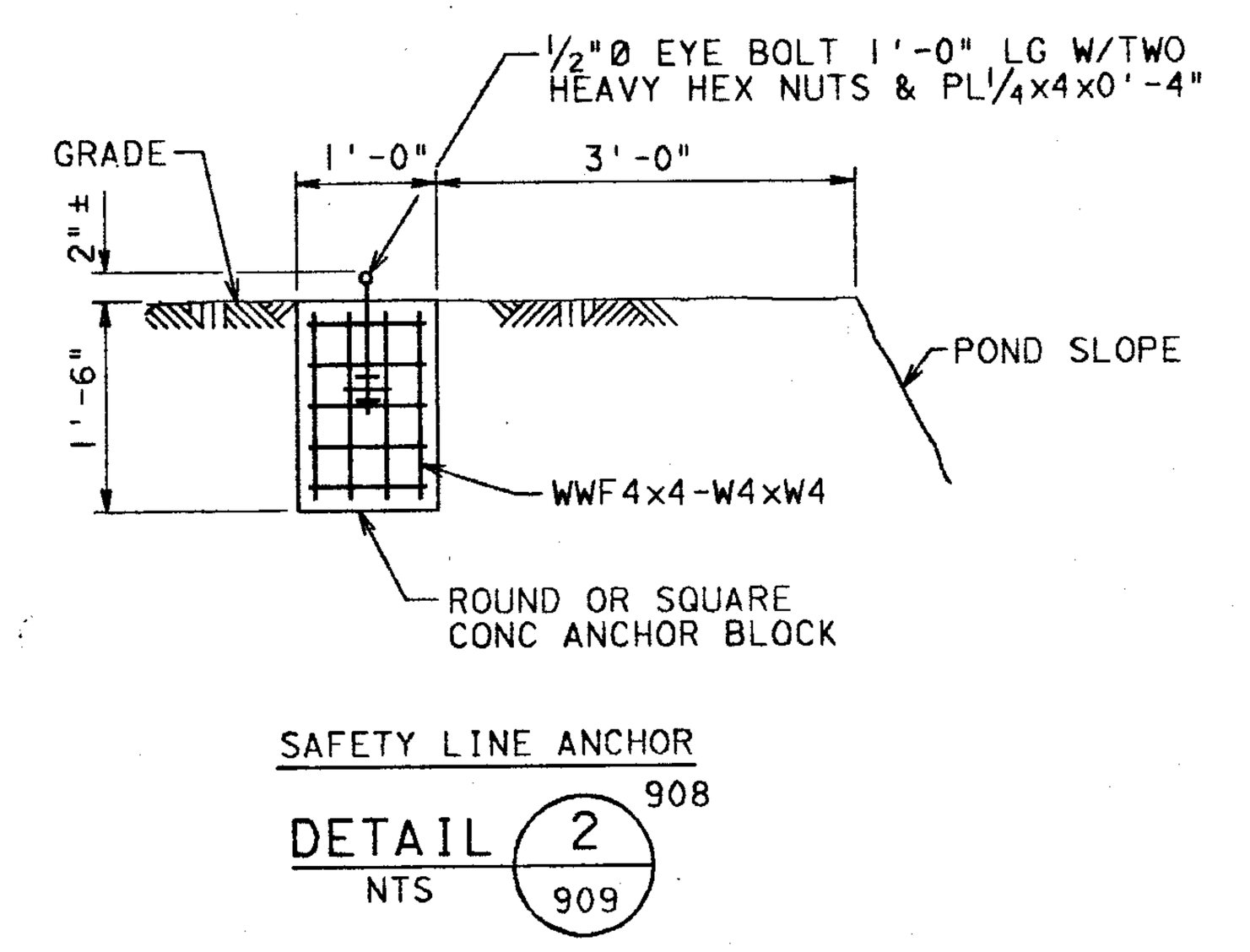
Department of Toxic Substances Control (DTSC). 2014. Well Design and Construction for Monitoring Groundwater at Contaminated Sites. California Environmental Protection Agency. June.

TRC. 2019. Revised Report of Waste Discharge. PG&E Hinkley Compressor Station. Hinkley, California. May 16.

USACE. 2014. Drilling in Earth Embankment Dams and Levees.







NOTES

1. ALL CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE 28-DAY STRENGTH OF 3000 PSI AND MAXIMUM AGGREGATE SIZE OF 1 1/2 IN. AND MEET ACI STD 318-89. CHAMFER ALL EXPOSED EDGES OF CONCRETE 3/4".
2. REINFORCING BARS SHALL BE DEFORMED BILLET STEEL GRADE 40 OR 60 CONFORMING TO ASTM A615 AND SHALL BE FREE FROM ANY BOND REDUCING COATING.
3. CONCRETE COVERING OF REINFORCEMENT SHALL BE 3 INCHES AGAINST GROUND.
4. SOIL UNDER STRUCTURES SHALL BE COMPACTED TO A MINIMUM 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557-C (78).
5. ALL ABRASION PADS SHALL BE WELDED TO THE LINER TO PREVENT PAD MOVEMENT.
6. CLAY SHALL HAVE A MAXIMUM PERMEABILITY OF 1×10^{-6} CM/SEC.
7. FOR GENERAL NOTES SEE DRAWING 488908.

REFERENCES

AREA - PLAN ---------- 488933
SITE ARRANGEMENT PLAN ---------- 488908
SECTIONS & DETAILS, PONDS 1 THRU 7 ---------- 488910
VADOSE ZONE MONITORING POND 8 ---------- 488911

WDR 0100756

488909#-##-###
D067865

NO.	DATE	DESCRIPTION	GM/SPEC	DWN	CHKD	SUPV	APVD BY
2	3-29-91	REVISED SUMP AND SUMP BOX				KSF	
1	10-08-90	APPROVED FOR CONSTRUCTION		GRD	YW/ST	KSF	FAC/JJT
02	6-22-90	ISSUED FOR REVIEW & COMMENT					
01	5-18-90	ISSUED FOR REVIEW & COMMENT					

REVISIONS

APPROVED BY KENT FERRE JJT

GM 194911-4
SUPV J. CHENG
DSGN Y. WONG
DWN S. HOPKINS
CHKD K. FERRE
DATE 10-08-90
SCALES AS NOTED

SOUTHERN PIPELINE OPERATIONS

SITE IMPROVEMENT - SECTIONS & DETAILS
SURFACE IMPOUNDMENTS, POND 8
HINKLEY COMPRESSOR STATION

GAS OPERATIONS
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

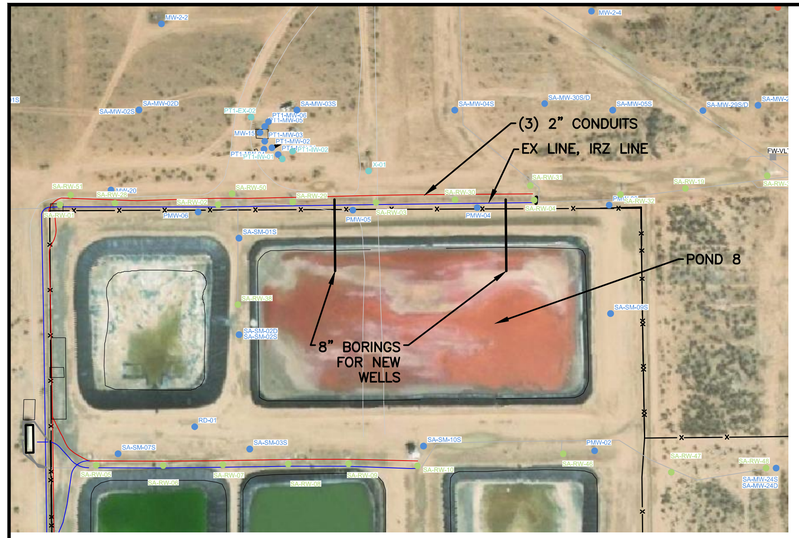
REGISTERED PROFESSIONAL ENGINEER KENT S. FERRE C 034629 EXP. 9-30-91 CIVIL STATE OF CALIFORNIA

MICROFILM
BILL OF MATL
DWG LIST
SUPSDS
SUPSD BY
SHEET NO. 488909 SHEETS REV 2

COORDINATED APPROVAL FOR CONSTRUCTION

[140,130]488909 .C04 03-27-91 SH

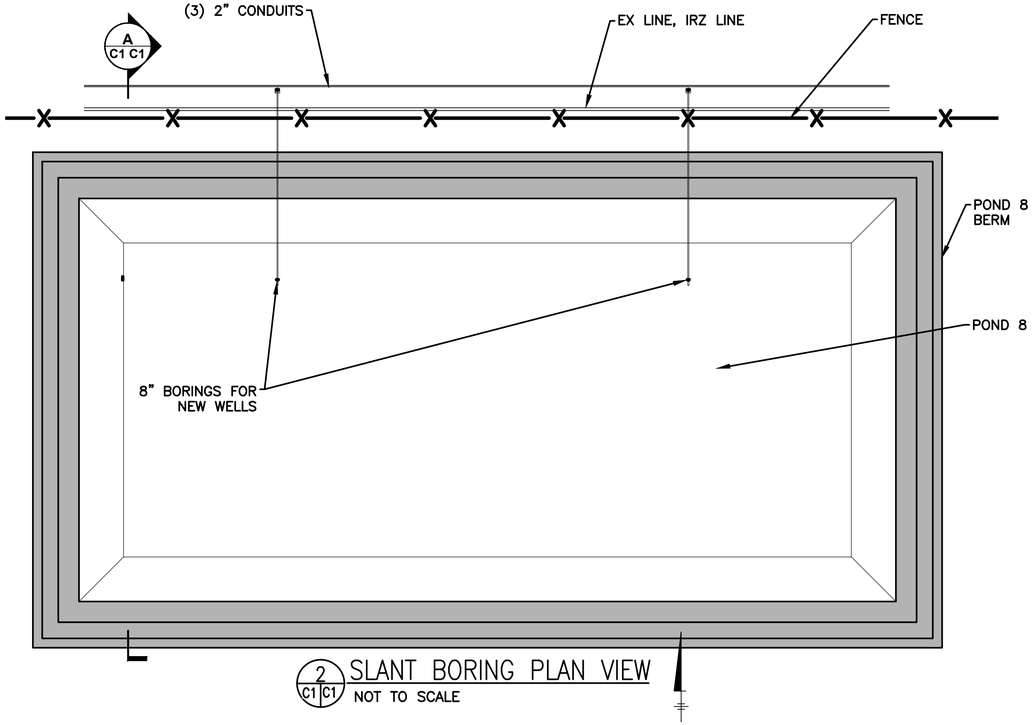
HINKLEY SITE IMPROVEMENT



1 C1 C1 POND 8 SITE PLAN

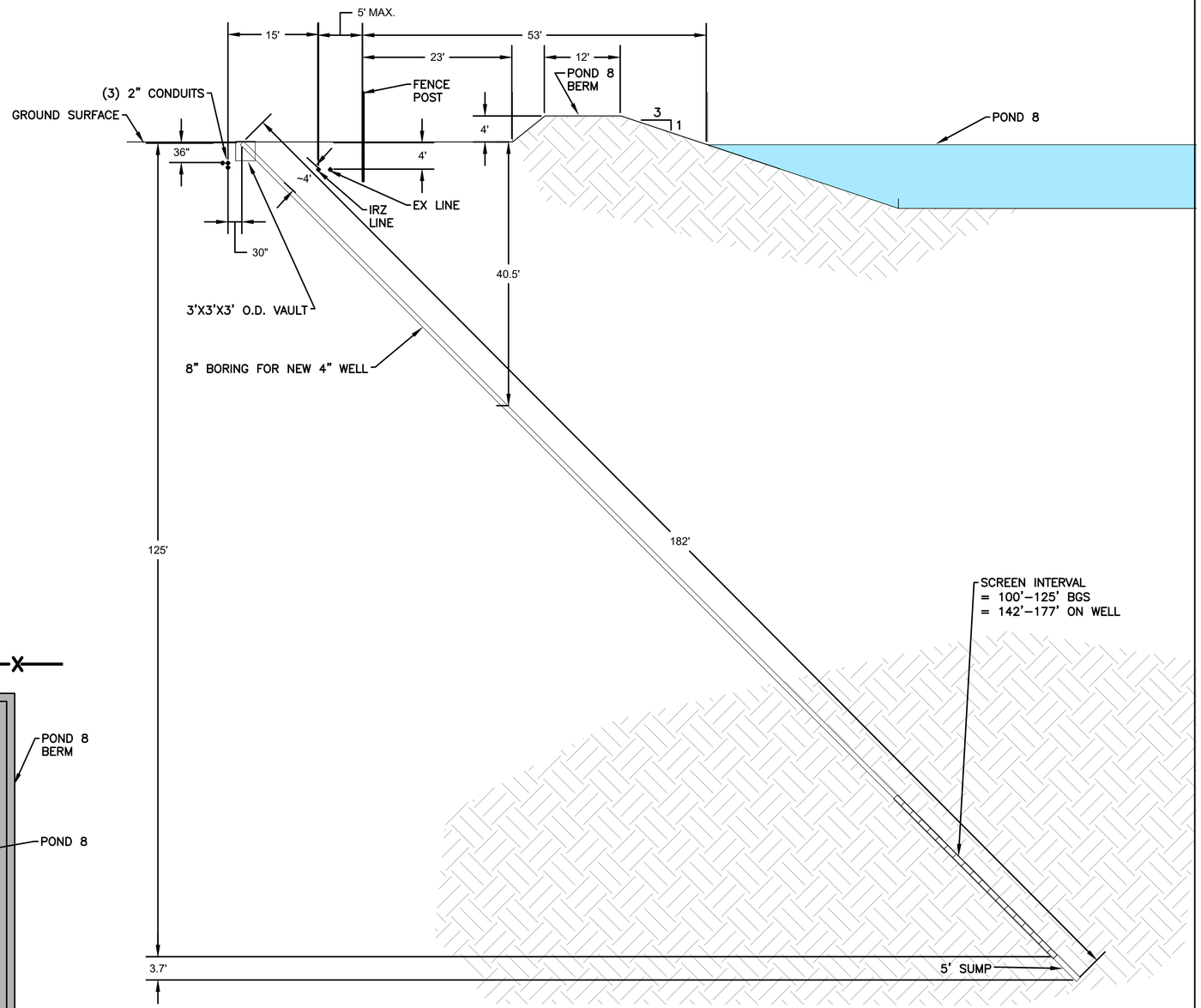
0 120' 240'

GRAPHIC SCALE



2 C1 C1 SLANT BORING PLAN VIEW

NOT TO SCALE



A C1 C1 SLANT BORING SECTION

NOT TO SCALE

SCALE AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd
1	4/2/20	REFERENCE	MC	BP

Professional Engineer's Name: **BRIAN PROWD**

Professional Engineer's No.

State	Date Signed	Project Mgr.
CA		B. Prowd

Designed by	Drawn by	Checked by
MC	BR	BP

ARCADIS U.S., INC.

HINKLEY COMPRESSOR STATION • HINKLEY, CALIFORNIA

SLANT BORING

NORTHERN SOURCE AREA INVESTIGATION

CROSS SECTION

ARCADIS Project No.
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Date
APRIL 2020

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C1